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Energy Analysis Techniques for Design
Micro-based Computer Aided Energy Systems Design

US Army Corps
of Engineers
Construction Engineering
Research Laboratory

Surveys of Architectural, Electrical, and Mechanical Hardware/Software Use and Needs

by
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Army designers are continually faced with the need to reduce energy use in new and existing construction while maintaining overall life cycle cost goals. However, designers sometimes experience problems incorporating available energy and economic analysis software into the design process. To help overcome this situation, surveys were administered at Corps-wide Mechanical/Electrical and Architectural conferences to (1) determine designers' software/hardware needs and (2) obtain the designers' opinions of automated products.

The survey results indicate that lack of training and lack of hardware/software are the most serious obstacles to full use of computers by designers. Ease of use and quality of training/support are among the chief criteria for selecting computer tools. Standardization of hardware and software is a high priority and poor interdisciplinary coordination interferes with the effective use of computer-aided design and drafting.

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FOREWORD

This work was performed for the Directorate of Military Programs, Headquarters, U.S. Army Corps of Engineers (HQUSACE), under Project 4A162781AT45, "Energy and Energy Conservation"; Technical Area A, "New Construction Energy Design"; Work Units, "Energy Analysis Techniques for Design" and "Micro-based Computer Aided Energy Systems Design." Mr. Dwight Beranek, CEMP-EE, was the HQUSACE Technical Monitor.

This work was performed by the Energy Systems Division (ES), U. S. Army Construction Engineering Research Laboratory (USACERL). Dr. G. R. Williamson is Chief of USACERL-ES.

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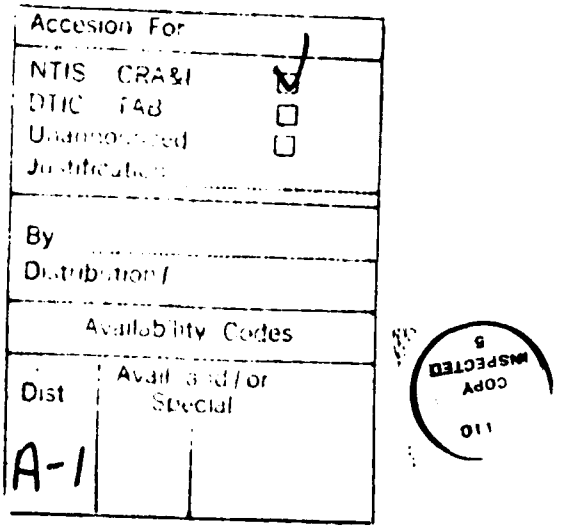

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SURVEYS OF ARCHITECTURAL, ELECTRICAL, AND MECHANICAL HARDWARE/SOFTWARE USE AND NEEDS

1 INTRODUCTION

Background

Army designers are continually faced with the need to reduce energy use in new and existing construction while maintaining overall life cycle cost goals. Although energy and economic analysis software is available, designers sometimes have problems incorporating these tools into the design process. Headquarters, U.S. Army Corps of Engineers (HQUSACE) tasked the U.S. Army Construction Engineering Research Laboratory (USACERL) to help overcome this situation.

Objectives

The objectives of this research were to (1) determine the designers' software needs and (2) obtain the designers' opinions of automated products as background information for future development of hardware/software.

Approach

In June 1987, the first Corps-wide Mechanical/Electrical Conference for designers was held in Atlanta, GA. Approximately 200 designers from Corps Districts, Divisions, and Laboratories as well as Army and Air Force Headquarters and installations attended. Because of the anticipated responsiveness of this audience, a hardware/software survey (Appendix A) was administered. The surveys were collected and quickly summarized for the attendees (Table 1). An organizational list of the attendees is in Appendix B. The survey was also given at two USACE PROSPECT courses for the "Energy Conservative Design for New Buildings." All surveys were processed at USACERL using a computer program that allowed data entry of the survey responses and compilation of answers. The results are compiled in Appendix C.

In December 1987, the first Corps-wide Architectural Conference for designers was held in Savannah, GA. Approximately 160 designers from Corps Districts, Divisions, and Laboratories as well as Army and Air Force Headquarters and installations attended. Because of the anticipated responsiveness of this audience, a hardware/software survey (Appendix D) was administered. The results are compiled in Appendix E. An organizational list of the attendees is in Appendix F.

2 MECHANICAL/ELECTRICAL SURVEY SUMMARY

Nearly all of those surveyed (93 percent) use computers in their work, but few (25 percent) have one on their desks.

A wide variety of mechanical design tools are in use, but the primary applications are for duct sizing, energy analysis, load calculation, and equipment selection. (Note that these are the basic capabilities of the better known commercial packages such as Trane CDS and Carrier E20-II.*) Word processing and spreadsheet use were cited as more common than Computer Aided Design and Drafting (CADD) and engineering tool use.

CADD was identified as both a best and a worst application. Word processing, spreadsheet calculations, and life cycle cost analysis applications were given high marks.

Respondents found the Corps software products to be competitive with comparable commercial products. This competitiveness is partly due to the low cost of Corps programs, which were otherwise noted to be cumbersome to use.

The most frequent response concerning tool selection was that it should be easy to use. Support, training, and documentation were also listed as important factors. Cost and standardization of algorithms were considered less significant.

However, in response to a question about criteria for approving the use of a tool, the primary concerns were the available benchmarks, quality documentation, and user experience with the program.

Principal problems preventing full use of computers were lack of training and time to train, lack of hardware and software, "poor support" of computer use, and personnel resistance.

The most important requirements for optimal computer use were standardization and ease of use. Technical capabilities and availability ranked second in importance. Support, training, and cost were also cited as significant factors.

Most respondents prefer on-the-job training, although virtually any type of training from contracted instruction to self-paced work with computer tutorials and manuals is as effective.

Of the approximately 50 percent of survey respondents who answered questions concerning energy analysis tool use, about 30 percent use a computer tool in all analyses. Nearly half use computer tools less than half of the time, however, and some respondents never use them.

There is considerable variety in current energy analysis practice. Hand calculations and simplified computer procedures such as bin method calculations are prevalent. The use of detailed analysis programs such as BLAST (Building Loads Analysis and System Thermodynamics, a USACERL-developed public domain program) is limited among those who use it at all.

The primary application of energy analysis continues to be compliance with budget requirements, although comparison of alternative design performance is done to some extent. Architectural and lighting design on the basis of energy analysis is less common. Respondents estimated that 50 to 60 percent of their analyses are for compliance purposes while 20 to 40 percent are for design purposes.

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*These are copyrighted packages of the Trane Company and Carrier Corporation, respectively.

According to those surveyed, mechanical engineers are presently performing the majority of energy analyses (88 percent). However, some think that electrical engineers, architects, and project managers should be doing a greater percentage of the energy analyses.

Respondents indicated that economic analysis is required in roughly 50 percent of both in-house and Architect/Engineer (AE) projects. In both cases, Life Cycle Cost in Design (LCCID) receives substantial use (60 percent in-house and 30 percent by AEs).

The Trane "Government Economics" program (the Trane version of LCCID) is used for about half of the AE life cycle cost analyses. The microcomputer version of LCCID is used more often for in-house analyses (60 percent), although the Trane version is also in wide use. Harris and Control Data Corporation versions are used less frequently. This is indicative of a preference for tools that are immediately available to the user (micro-based). It may also indicate preference for tools that are well-integrated into a larger package of design tools (e.g., Trane CDS).

3 ARCHITECTURAL SURVEY SUMMARY

Although a majority (84 percent) of the surveyed conference attendees use computers in their work, few (27 percent) have a dedicated terminal or workstation on their desks. The ratio of users to users with their own computers is lower for the engineers surveyed (0.26) than for the architects (0.32). This is surprising because engineers are traditionally considered more numerically and computer oriented since they perform design calculations more frequently.

The application with the highest priority to this group was drawing. Other computer uses cited as desirable were project management functions such as generation of contract documents, criteria checks, and scheduling.

Good graphic input/output (I/O) rated high among factors influencing the selection of a CADD product. Ease/speed of use and quality of documentation are also very important.

The primary use of computers in the respondents' offices was word processing. Other functions served by computers with some frequency were CADD (drawing) and spreadsheet calculation. Scheduling tools and communications software received more limited use.

Responses to questions asking for least and most successful computer applications indicated repetitive drawing tasks are being accomplished satisfactorily by systems now in the field. On the other hand, drawing applications received negative effectiveness comments when used for unique designs.

Poor support of computer use and personnel resistance were again identified as detractors to full computer use. The primary factors cited as contributors to limited computer use were lack of training, lack of time to train, and lack of hardware and software. The quality of hardware and software was not identified as a major problem.

Conditions required for optimal use of computers in the design process were indicated to be standardization of systems and procedures, improved ease of use, availability of training, and a good ratio of users to computers.

Current needs included improving CADD architectural software and better communication between authors of software and end-users. The three highest priorities, however, were more time allocated for training, more money for needed hardware and software, and better interdisciplinary teamwork.

The group of architects polled currently does not have much involvement with either energy or life cycle cost analysis. They expressed the opinion that detailed energy analyses using complex tools like BLAST should be the duty of mechanical engineers and that tools to be used by architects ought to emphasize speed and simplicity.

Concerns about the capabilities of Corps energy analysis tools included the availability of passive solar analysis, high quality lighting design features, ease of use, and ability to run on a microcomputer.

4 RECOMMENDATIONS

These surveys identified the following opportunities for responses in all management levels and Research and Development (R&D) spheres:

1. Lack of training and lack of hardware/software are the most serious obstacles to full use of computers.

These problems should be addressed by management at all levels (HQUSACE, Field Operating Agencies [FOAs], MACOMs). It would take a great deal of money to provide every engineer and architect in the Corps with a microcomputer or CADD workstation, but it should be a priority to increase the availability of hardware by using any available resources. Likewise, it may not be feasible to provide extensive training to each person involved in CADD, but consideration should be given to authorizing more extensive training for persons selected to be experts in a particular type of analysis. Furthermore, allowing for "discovery" time in the office during which personnel would familiarize themselves with hardware and software tools, would eventually pay dividends in greater acceptance of computerized procedures and increased productivity.

2. Ease of use and quality of training/support are among the chief criteria for selecting computer tools.

Corps R&D should place special emphasis on developing better user interfaces. Whether graphic or text oriented, input processors should be as clear and helpful as current technology allows. Computer tutorials were cited as one of the preferred forms of training. Consideration should be given to developing tutorials for both Corps software and Corps applications of commercial software. Support for Corps software products must be at a level competitive with the popular commercial products. Poorly supported programs tend not to be used, all other factors being equal.

3. Standardization of hardware and software is a high priority.

The Corps-wide CADD purchase is a step in this direction. The Corps should vigorously encourage the development of generic formats in CADD applications and should insist on compatibility of Corps developed programs intended to be used in an interdisciplinary CADD environment.

4. Poor interdisciplinary coordination interferes with effective use of CADD.

Management should investigate ways of modifying the design process to take advantage of the opportunities afforded by CADD. There is also a need to develop and integrate tools into CADD systems to increase interdisciplinary design. Such tools could include knowledge-based systems or simplified analysis tools that could provide rapid, approximate assessment of, for example, the energy impact of architectural design decisions at a point in the design process that would allow the architect to investigate alternative solutions.

The development of public domain software (such as BLAST and LCCID) by or for the Corps should consider several items in the surveys. Ease of use is a very high priority. However, it should also be noted that this survey indicates Corps software scores high in acccuracy, though may be cumbersome. If this software could be made easy to use, the users would readily accept it.

The BLAST development team should develop more HVAC system and equipment models, an interface with CADD systems, an interface with graphic reporting systems, better documentation, and execution on 32 bit workstations or microcomputers. Among the 26 BLAST users who answered the questionnaire, the majority (18) are using a preprocessor (such as BTEXT) as the normal method of inputting building models. This action indicates a change in BLAST input file developments. Note

that the surveys preceded the announcement of PC-BTEXT that will further help input file development.

LCCID or one of its commercial clones has been readily accepted in the economic analysis studies required during design. No immediate enhancements to the LCCID software are indicated by this survey.

APPENDIX A:

ELECTRICAL/MECHANICAL ENGINEERING CONFERENCE HARDWARE/SOFTWARE SURVEY

Please take a few minutes to complete the following survey regarding your present and anticipated use of computer hardware and software. The survey is organized into several sections with general and specialized applications questions. Please complete all the sections that apply to you. Most questions will ask you to respond by placing an X on the lines provided. Where these boxes are followed by _____ blank lines, please also fill in additional information on the response.

The Corps lacks good information on computer usage. We would like as close to a 100% response on the survey as possible. THIS INFORMATION IS IMPORTANT FOR THE CORPS (and will only be used by the Corps). Your answers will help guide USACE policy on hardware and software for our disciplines. Preliminary results of the survey will be given in the M/E Software presentation on Thursday. A handout will also be prepared with some results.

Please hand in the completed survey first thing Wednesday morning to your session chairman.

SECTION A. IDENTIFICATION

1. NAME (optional)_____

2. OFFICE SYMBOL _____

3. TEL. NO. (optional) FTS _____
   Comm ( )_____

4. POSITION TITLE _____

5. ENG. DISCIPLINE (i.e. EE, ME, CET)_____

SECTION B. GENERAL (ALL COMPLETE)

6. Place an X in the spaces for all computer types for which you HAVE ACCESS in your office:

_CDC Cybernet
_Other Mainframe_____
_District Harris
_Other Minicomputer_____
_Division Honeywell
_CADD Workstation (Mfr)_____
_Other(s)_____
_____

_IBM PC or Compatible
_PC/XT
_PC/AT
_32 bit Workstation
(Mfr)_____
_APPLE (Model)_____
_NONE

7. Place an X in the spaces of all computers you USE in the office at least occasionally:

_CDC Cybernet
_Mainframe_____
_District Harris
_Other Minicomputer_____
_Division Honeywell
_CADD Workstation (Mfr)_____
_Other(s)_____
_____

_IBM PC or Compatible
_PC/XT
_PC/AT
_32 bit Workstation
_(Mfr)_____
_APPLE (Model)_____
_NONE

8. Place an X in the spaces of all computers you WILL HAVE ACCESS TO by the END OF FY88:

_CDC Cybernet
_Other Mainframe_____
_District Harris
_Other Minicomputer_____
_Division Honeywell
_CADD Workstation (Mfr)_____
_Other(s)_____
_____

_IBM PC or Compatible
_PC/XT
_PC/AT
_32 bit Workstation
(Mfr)_____
_APPLE (Model)_____
_NONE

9. Do you have a computer or terminal on your desk?

YES NO

10. If you answered yes to Question #9 place an "X" in the spaces applicable for the computer or terminal on your desk:

Terminal (Mfr)_____
Computer Terminal is Networked to if any _____

Computer (Name: PC, PC/XT, Apple IIE, etc.)_____

Hard Disk 10MB 20MB 40MB _____ MB

Modem _____ Baud

Printer On Desk Remote

_Daisywheel
_Dot Matrix
_Laserprinter

11. Place an X next to the four most important problems IN YOUR OFFICE regarding the use of computer technology:

_Lack of hardware
_Lack of software
_Lack of training
_No time to learn
_No good applications for computers

_Personnel resistance to computers
_Poor support for computers in office
_Noise level of computers and printers
_Expense of computers and software
_Management does not support computer use
_Lack of phone lines for modems
_Present hardware inadequate
_Engineers not given ready access to hardware needed
_Other(s) List _____
_____
_____

12. Name the function(s) in your office you would most like to automate:

_____

_____

13. Do you own a computer for home use?

NO YES (Type)_____

SECTION C. (TO BE COMPLETED BY ALL COMPUTER OR TERMINAL USERS)

14. State the types of training you consider most effective FOR YOU on computer hardware or software by numbering your preferences in the spaces below (#1 being your top preference):

_Contracted training
_Formal training by office staff
_Computer tutorials
_Manuals
_Telephone support from mfr.
_On the job training
_Co-workers
_Other _____
_____

15. Place an X in the spaces for YOUR use(s) of computer hardware and software in your office:

_Wordprocessing (Name of program(s))_____
_Spreadsheets (Program(s))_____
_Data base managers (Program(s))_____
_Communication (Program(s))_____
_Energy analysis (See separate section also)
_Other engineering computations (See separate section also)
_CADD for drawing
_CADD for engineering calculations
_Scheduling and time management
_Management Information Systems (required by office)

_Other(s) _____
_____
_____

SECTION D. M&E SOFTWARE (TO BE COMPLETED BY ALL COMPUTER USERS)

16. Place an X in the spaces next to the M&E applications for which YOU have used software in at least a portion of the task (also state the program name when asked):

_Electrical Distribution Design (Program(s)_____
_Lighting Design and Analysis (Program(s))_____
_Overcurrent Protection Coordination (Program(s))_____
_Other Electrical Design (Program(s))_____
_Piping Design (Program(s))_____
_Duct Sizing (Program(s))_____
_Energy Analysis (See separate section also)_____
_Interference Checking (Program(s))_____
_Cooling and Heating Coil Selection (Program(s)_____
_HVAC System and Equipment Selection (Program(s))_____
_Heating and Cooling Load Calculation (Program(s))_____
_ASHRAE 90 Compliance (Program(s))_____
_Solids Modeling (Program(s))_____
_Strength of Materials (Program(s))_____
_Other Mechanical Applications_____
Program(s)_____

17. What task or function do you feel has been most successful on a computer?_____

Why?_____

18. What task or function do you feel has been the least successful on a computer?_____

Why?_____

19. State your overall (ease of use, support, accuracy, price) preferences for engineering software developers for programs YOU HAVE USED by placing a number (#1 being highest rated) in the spaces of the developers below. State the major strength and weakness of each used.

RANK/DEVELOPER	STRENGTH	WEAKNESS
_APEC	_____	_____
_CARRIER	_____	_____
_TRANE	_____	_____
_ELITE	_____	_____
_INTERGRAPH	_____	_____
_OTHER CADD (_____)	_____	_____
_HEC	_____	_____
_CERL	_____	_____
_WES	_____	_____

__HUNTSVILLE DIV _____ _____
__OTHER _____ _____
__OTHER _____ _____
__OTHER _____ _____

20. Place an X in the spaces next to the five attributes of engineering software that carry the most weight regarding your selection of programs:

__Price
__Ease of use
__Quality of manuals and other documentation
__Software support from developer
__Conformance of calculations to results of hand calcs
__Access to computer code for examination
__Reputation of developer
__Graphics input
__Graphics output
__Speed of use
__Advertised features and compliancies
__Previous experience with the program
__Other _____
__Other _____

21. Place an X in the spaces next to the MAJOR considerations you have regrading the use of software by AEs?

__Reputation of the AE
__Your personal familiarity with using the program
__Reputation of the program
__Your ability to check the results against a benchmark program or hand calculations
__Documentation provided by the AE about the program
__Other _____
__Other _____

22. Have you disapproved a program that an AE wanted to use?

NO YES

Why?_____

23. What recommendations do you have for others regarding the use of software by AEs?

_____

_____

_____

24. Place an X in the spaces next to the five most pressing problems you feel the Corps faces in computer use?

__Users are not consulted before software is developed
__Too much oversight on software by HQUSACE
__Not enough oversight on software by HQUSACE
__Too many programs to choose from
__Little ability to force AEs to use certain programs
__Corps labs and Huntsville developing too much useless software
__CADD systems need improvement in engineering analysis applications
__Poor interdisciplinary design teamwork
__Design schedules are too tight to permit learning and using programs
__Need more money for hardware and software
__Other_____
__Other_____
__Other_____

25. If it were up to you what would the essential ingredients of the Corps hardware and software usage be?

A._____

B._____

C._____

D._____

SECTION E. ENERGY ANALYSIS (TO BE COMPLETED BY ALL USERS AND REVIEWERS OF ENERGY ANALYSIS PROGRAMS)

26. What are your principal duties regarding energy analysis?

Perform analyses Review Analyses Perform and Review

27. How often do you personally perform energy analysis calculations?

Less than once a quarter
Once a quarter
Once a month
Once a week
Other _____

28. Of the energy analyses you perform what percentage are conducted using a computer program?

100%
90%
75%
50%

Less than 50%
Other_____

29. Place an X in the spaces next to all purposes for which you perform a computer or hand calculation energy analysis. Place a number next to all selections indicating the percentage of the total energy analyses for which you perform that function.

__To comply with Energy Budget requirements _____%
__To compare HVAC alternatives' energy consumption and life cycle costs _____%
__To compare alternate architectural features such as windows and insulation _____%
__To compare alternate lighting and/or electrical power systems _____%
__To size HVAC systems and equipment _____%
__To select orientation and other siting considerations _____%
__Other _____ _____%
__Other _____ _____%

30. Place an X in the spaces for purposes AEs use energy analysis on your office's project. Place an approximate percentage of the time they perform these functions:

__To comply with Energy Budget requirements _____%
__To compare HVAC alternatives' energy consumption and life cycle costs _____%
__To compare alternate architectural features such as windows and insulation _____%
__To compare alternate lighting and/or electrical power systems _____%
__To size HVAC systems and equipment _____%
__To select orientation and other siting considerations _____%
__Other _____ _____%
__Other _____ _____%

31. Place an X in the spaces next to the energy analysis tools YOU use in your office. Place the percentage of the analyses performed with these tools in the space next to each of your selections:

__Hand calculations _____%
__Carrier OPCOST program _____%
__ASEAMII program _____%
__Other BIN programs_____ _____%
__DOE 2.1 (Mainframe version) _____%
__DOE 2.1 (PC version) _____%
__BLAST _____%
__Trane TRACE _____%
__APEC ESPII _____%
__ELITE _____%
__BRUT _____%
__Other _____ _____%
__Other _____ _____%

32. Place an X next to the energy analysis tools used by AEs on your projects. State the approximate percentage of the time AEs use these tools:

__Hand calculations _____%
__Carrier OPCOST program _____%
__ASEAMII program _____%
__Other BIN programs_____ _____%
__DOE 2.1 (Mainframe version) _____%
__DOE 2.1 (PC version) _____%
__BLAST _____%
__Trane TRACE _____%
__APEC ESPII _____%
__ELITE _____%
__BRUT _____%
__Other _____ _____%
__Other _____ _____%

33. Place an X in the spaces of the five most important features an energy analysis tool should have for you to use it or permit AEs to use it (assume the application is a new air conditioned building of more than 100,000 sq ft floor area):

__Calculations are accurate compared to some benchmark
__Input required is limited
__Building model can be very detailed
__HVAC systems and equipment models are extensive
__Lighting systems models are extensive
__There is good capability to perform daylighting calculations
__Good capability for passive solar
__Good capability for active solar
__Program is easy to learn
__Program runs on a microcomputer
__Computation time for an annual run is relatively fast
__I have or AE has used it before
__Training for the program is good
__Support for the program is good
__Program is public domain
__Program documentation is good
__Program uses "screens" for input
__Program uses menus for input
__Text editor is easy to use
__Other _____
__Other _____

34. State the percentage of energy analyses conducted by the following disciplines in your office:

Mechanical engineers _____%
Electrical engineers _____%
Architects _____%
Project managers _____%
Engineering technicians _____%
Other _____ _____%

35. In your opinion what percentage of energy analyses SHOULD BE performed by the following disciplines in your office?

Mechanical engineers _____%
Electrical engineers _____%
Architects _____%
Project managers _____%
Engineering technicians _____%
Other _____ _____%

36. Please list any suggestions you have for improving energy analysis tools and/or criteria:

_____

_____

_____

37. Have you disapproved the proposed use of any energy analysis program by an AE?

NO YES

Why?_____

SECTION F. (TO BE COMPLETED BY ALL USERS AND REVIEWERS OF THE BLAST COMPUTER PROGRAM)

38. How often do you use or review BLAST?

__Less than once a quarter
__Once a quarter
__Once a month
__Once a week
__More than once a week
__Other _____

39. Place an X in the spaces next to the computer(s) you run BLAST on. State the percentage of runs on that computer for each selection:

__CDC Cybernet _____%
__District Harris _____%
__DEC VAX _____%
__Other _____ _____%

40. Place a number in the spaces of the five highest priorities of new features you would like to see in BLAST:

__More HVAC systems and plants models
__More lighting models
__Integrated loads, systems and plants modules

__Easy interface with graphics programs for reports
__Interface with CADD systems
__Run on a 32 bit engineering workstation
__Run on a 32 bit microcomputer
__Provide better documentation
__Microcomputer preprocessor
__Microcomputer postprocessor
__Other _____
__Other _____

41. Would you be interested in helping to demonstrate completed enhancements to BLAST if funds were provided for the demonstration?

NO YES

42. What are your two biggest concerns about using BLAST?

a._____

b._____

43. Place an X in the spaces next to the means you use to input BLAST. Place a percentage of total runs of each input means in the space provided.

__Regular BLAST input scheme_____%
__BTEXT text preprocessor_____%
__SKETCH/BIP preprocessor_____%
__ARCH/ENERGY preprocessor_____%

SECTION G. (TO BE ANSWERED BY THOSE PERFORMING OR REVIEWING ECONOMIC ANALYSES)

44. What percentage of in-house projects involve economic analyses (i.e. life cycle cost studies) to help make design selections?

_____%

45. What percentage of AE projects require similar economic studies?

_____%

46. Have you used the Corps Life Cycle Cost In Design (LCCID) economic analysis computer program?

NO YES

47. What percentage of in-house economic analyses are performed using LCCID?

_____%

48. What percentage of AE performed economic analyses are conducted using LCCID?

_____%

49. Place an X in the spaces for the version of LCCID used by you. State the percentage of that use in the space provided:

__CDC Cybernet _____%
__Harris _____%
__Micro _____%
__Trane's "Government Economics" _____%

50. Place an X in the spaces for the version of LCCID used by AEs. State the percentage of that use in the space provided:

__CDC Cybernet _____%
__Harris _____%
__Micro _____%
__Trane's "Government Economics" _____%

THANK YOU VERY MUCH FOR COMPLETING THIS SURVEY - PLEASE HAND IT IN WEDNESDAY TO YOUR SESSION CHAIRMAN

APPENDIX B:

MECHANICAL/ELECTRICAL RESPONDENT IDENTIFICATION

Mechanical/Electrical Survey Respondents
June 12-14, 1987; Atlanta, Georgia
August 1-5, 1987; Kansas City, Missouri
September 14-18, 1987; Huntsville, Alabama

Office Symbol		Surveys Returned
MACOMs/DEHs	HQ. TRADOC	18
Others (EACA/FESA)		2
HQDA		
CEEC	HQUSACE	2
CEEC-OVEST	HQUSACE-OVEST	
CECER	Const. Eng. Res. Lab.	2

Office Symbol		Division/ District	Surveys Returned
CEEUD	Europe Division	EUD	1
CEHND	Huntsville Division	HND	3
CELMD	Lower Miss. Valley Div.	LMV	1
		LMK	6
		LMN	1
		LMM	3
		LMS	3
CEMRD	Missouri River Division	MRD	2
		MRK	2
		MRO	4
CENED	New England Division	NED	2
CENAD	North Atlantic Division	NAD	2
		NAB	2
		NAN	2
		NAO	1
CENCD	North Central Division	NCD	1
		NCR	2
		NCS	1
		NCB	2

Office Symbol		Division/ District	Surveys Returned
CENPD	North Pacific Division	NPD	8
		NPP	5
		NPS	4
		NPW	2
CEORD	Ohio River Division	ORD	1
		ORL	2
		ORH	1
		ORN	6
		ORP	1
CEPOD	Pacific Ocean Division	POD	3
		POF	2
		POJ	1
CESAD	South Atlantic Division	SAD	1
		SAJ	2
		SAM	12
		SAI	2
		SAS	12
		SAW	2
CESPD	South Pacific Division	SPD	1
		SPL	2
		SPK	8
CESWD	Southwestern Division	SWD	4
		SWA	2
		SWF	5
		SWL	2
		SWT	2
		SWG	2
Other		18	
		TOTAL:	176

NOTE: 18 attendees did not give their name or office symbol on the completed survey.

APPENDIX C:

MECHANICAL/ELECTRICAL RESULTS COMPILATION

Mechanical/Electrical Survey
June 12-14, 1987; Atlanta, Georgia
August 1-5, 1987; Kansas City, Missouri
September 14-18, 1987; Huntsville, Alabama

SURVEY ANALYSIS

Section A. Identification

Total # of responses: 176
# of supervisory positions: 42
# of ME responses: 95
# of EE responses: 58
Other disciplines that responded:

- BSEE/MSEA
- ME/EE
- EET
- IE
- CE
- ARCHITECT

SECTION B. GENERAL

6. Place an X in the spaces for all computer types for which you HAVE ACCESS in your office:

37	CDC Cybernet
13	Other Mainframe: PRIME, AMDAHL, DPS@WES, TRANE, IBM
07	District Harris
24	Other Minicomputer: MACINTOSH, VAX
32	Division Honeywell
71	CADD Workstation (Mfr): AUTODESK, AUTOCAD, INTERGRAPH, AUTOTROL, CALMA, TECHTRONIX, IBM
113	IBM PC or Compatible
59	PC/XT
67	PC/AT
7	32 bit Workstation (Mfr): INTERGRAPH, TECHTRONIX, HP
5	APPLE
10	Other
10	NONE

7. Place an X in the spaces of all computers you USE in the office at least occasionally:

16	CDC Cybernet
4	Other Mainframe: PRIME, TRANE, WES
61	District Harris

12 Other Minicomputer
5 Division Honeywell
40 CADD Workstation (mfr): AUTODESK, AUTOCAD, INTERGRAPH, IBM, CALMA
95 IBM PC or Compatible
46 PC/XT
63 PC/AT
3 32 bit Workstation (Mfr)
5 APPLE (Model)
12 Other
13 NONE

8. Place an X in the spaces of all computers you WILL HAVE ACCESS TO by the END OF FY88:

28 CDC Cybernet
13 Other Mainframe: PRIME, AMDAHL, DPS@WES, TRANE, IBM
88 District Harris
16 Other Minicomputer: MACINTOSH, VAX
25 Division Honeywell
70 CADD Workstation (Mfr): AUTODESK, AUTOCAD, INTERGRAPH, CALMA
98 IBM PC or Compatible
52 PC/XT
76 PC/AT
12 32 bit Workstation (Mfr): INTERGRAPH, APOLLO
6 APPLE (Model)
9 Other
4 NONE

9. Do you have a computer or terminal on your desk?

57 Yes

10. If you answered yes to Question #9 place an X in the spaces applicable for the computer or terminal on your desk:

19 Terminal (Mfr): ZENITH, PRIME, WYSE, HDS
53 Computer (Name: PC, PC/XT, Apple IIE, etc.): ZENITH, IBM/PC, PCXT, PC/AT, DATAKIT, CZPRO
32 Hard Disk
10 10MB, 26 20MB, 4 40MB
33 Modem
- From 300 to 9600 BAUD Capabilities
51 Printer
39 On Desk, 12 Remote
7 Daisywheel, 47 Dot Matrix, 7 Laserprinter

11. Place an X next to the four most important problems IN YOUR OFFICE regarding the use of computer technology:

106 No time to learn
91 Lack of training
62 Lack of hardware
57 Lack of software

28 Lack of phone lines for modems
27 Poor support for computers in office
26 Personnel resistance to computers
26 Other 1
23 Engineers not given ready access to hardware needed
22 Expense of computers and software
21 Present hardware inadequate
16 Noise level of computers and printers
13 Other 2
13 No good applications for computers
10 Management does not support computer use
3 Other 3

12. Name the function(s) in your office you would most like to automate:

- GEMENT, REPORTS, DRAFTING, BUDGET
- NONE

13. Do you own a computer for home use?

56 Yes responses
- COMMODORE
- TI
- CORDATA
- ATARI
- ZENITH
- APPLE
- PC/XT

SECTION C. COMPUTER USAGE

14. State the types of training you consider most effective FOR YOU on computer hardware or software by numbering your preferences in the boxes below (#1 being your top preference):

No. Response	Category	Overall Rating
125	On the job training	2.19
110	Contracted training	2.30
95	Formal training by office staff	2.86
96	Co-workers	3.16
95	Computer tutorials	3.21
96	Manuals	3.72
72	Telephone support from Mfr.	5.58
8	Other	1.13

15. Place an X in the spaces for YOUR use(s) of computer hardware and software in your office:

118 Wordprocessing: WORDSTAR, INFO, MULTIMATE, WORDPERFECT, ENABLE, WORDMARC, SMART, FRAMEWORK, PFS, UNKNOWN
91 Spreadsheets: SUPERCALC, LOTUS, MULTIPLAN, ENABLE, SYMPHONY, V-CALC
57 Data base managers: DBASE, ENABLE, INFORMIX
51 Communication: PROCOMM, CROSSTALK, ON-TYME, ENABLE, SMARTCOM

44 Energy analysis
41 Other engineering computations
53 CADD for drawing
15 CADD for engineering calculations
26 Scheduling and time management
16 Management information systems
29 Other: FORMTOOL, SIDEKICK, MATHCAD, AUTOCAD, LCCID, SIGN MASTER, DIAGRAPH

SECTION D. M&E SOFTWARE

16. Place an X in the spaces next to the M&E applications for which YOU have used software in at least a portion of the task (also state the program name when asked):

18 Electrical Distribution design: DAPPER-CAPTOR, CADD, ELITE
21 Lighting design and analysis: ELITE, OWN
12 Overcurrent protection coordination: CAPTOR, BUSS, ELITE
19 Other electrical design
24 Piping design: CARRIER, INHOUSE, HP2M, TRANE, PIPENET
36 Duct sizing: CARRIER, TRACE, VARITRANE, DUCTMATE, ELITE
36 Energy analysis
2 Interference checking
29 Cooling and heating coil selection: CARRIER, TRANE
26 HVAC system and equipment selection: CARRIER, TRANE
34 Heating and cooling load calculation: CARRIER, ELITE, TRANE
5 ASHRAE 90 compliance
1 Solids modeling
2 Strength of materials
16 Other Mechanical applications: LCCID, Mec

17. What task or function do you feel has been most successful on a computer?

- WORDPROCESSING, CALCULATIONS, REPORTS, WORDSTAR, LCCID, SPREADSHEETS, CADD

Why?

- MANUFACTURERS, SPEED, SIMPLICITY

18. What task or function do you feel has been the least successful on a computer?

- NONE, SCHEDULING, CADD, BLAST, DESIGN-DRAWINGS, INFO (A Harris Database Language), AUTOCADD

19. State your overall (ease of use, support, accuracy, price) preferences for engineering software developers for programs YOU HAVE USED by placing a number (#1 being highest rated) in the spaces of the developers below. State the major strength and weakness of each used.

3 APEC; No Comments
19 CARRIER; Weakness: SUPPORT
25 TRANE; Strength: SUPPORT; Weakness: MANUALS, COMPLICATED
20 ELITE; No Comments
13 INTERGRAPH; Strength: GREAT; Weakness: GS
15 OTHER CADD; Strength: Auto; Weakness: DESIGN
2 HEC; No Comments

25 CERL; Strength: VARIETY, THOROUGH, COST, BLAST; Weakness: CUMBERSOME
2 WES; No Comments
2 HUNTSVILLE DIV; No Comments
23 OTHER

20. Place an X in the spaces next to the five attributes of engineering software that carry the most weight regarding your selection of programs:

103 Ease of use
76 Quality of manuals and other documentation
61 Software support from developer
61 Speed of use
55 Conformance of calculations to results of hand calcs
44 Price
28 Previous experience with the program
21 Reputation of developer
14 Graphics output
11 Advertised features and compliancies
7 Access to computer code for examination
7 Graphics input
7 Other
3 Other

21. Place an X in the spaces next to the MAJOR considerations you have regarding the use of software by AEs?

72 Your ability to check the results against a benchmark program or hand calculations
53 Documentation provided by the AE about the program
51 Your personal familiarity with using the program
32 Reputation of the program
27 Reputation of the AE
2 Other
3 Other

22. Have you disapproved a program that an AE wanted to use?

22 Yes responses

23. What recommendations do you have for others regarding the use of software by AEs?

- NONE

24. Place an X in the spaces next to the five most pressing problems you feel the Corps faces in computer use?

72 Design schedules are too tight to permit learning and using programs
54 Users are not consulted before software is developed
44 Poor interdisciplinary design teamwork
39 Other (BLAST, TRAINING)
33 Need more money for hardware and software
28 Too many programs to choose from

26 Corps labs and Huntsville developing to much useless software
24 CADD systems need improvement in engineering analysis applications
13 Not enough oversight on software by HQUSACE
7 Too much oversight on software by HQUSACE

25. If it were up to you what would the essential ingredients of the Corps hardware and software usage be?

- Compatibility
- Speed
- Uniformity
- Simple
- Availability
- Versatility
- Accuracy
- Documentation
- Cost
- Support
- Fast
- Training

SECTION E. ENERGY ANALYSIS USAGE and REVIEW

26. What are your principal duties regarding energy analysis?

33 Review analyses
26 Perform and review
16 Perform analyses

27. How often do you personally perform energy analysis calculations?

30 Less than once a quarter
17 Other (NONE, SELDOM)
14 Once a quarter
6 Once a month
5 Once a week

28. Of the energy analyses you perform what percentage are conducted using a computer program?

19 100%
9 90%
5 75%
10 50%
22 Less than 50%
10 Other (NONE, SELDOM)

29. Place an X in the spaces next to all purposes for which you perform a computer or hand calculation energy analysis. Place a number next to all selections indicating the percentage of the total energy analyses for which you perform that function.

No. Response	Category	Overall Rating
34	To comply with energy budget requirements	61.26
39	To compare HVAC alternatives energy consumption and life cycle costs	38.28
33	To size HVAC systems and equipment	33.58
8	Other	43.75
12	To compare alternate architectural features such as windows and insulation	32.50
9	To compare alternate lighting and/or electrical power systems	22.78
7	To select Orientation and other siting considerations	46.43

30. Place an X in the spaces for purposes AEs use energy analysis on your office's project. Place an approximate percentage of the time they perform these functions:

No. Response	Category	Overall Rating
34	To comply with energy budget requirements	47.20
38	To compare HVAC alternatives, energy consumption and life cycle costs	40.26
11	To compare alternate architectural features such as windows and insulation	31.82
9	To compare alternate lighting and/or electrical power systems	27.78
30	To size HVAC systems and equipment	36.34
6	To select orientation and other siting considerations	19.17
1	Other	100.00

31. Place an X in the spaces next to the energy analysis tools YOU use in your office. Place the percentage of the analyses performed with these tools in the space next to each of your selections:

No. Response	Category	Overall Rating
49	Hand calculations	46.45
3	Carrier OPCOST program	75.00
0	ASEAMII program	
1	Other BIN programs	80.00
0	DOE 2.1 (mainframe version)	
3	DOE 2.1 (PC version)	13.21
25	BLAST	29.08
17	Trane TRACE	45.88
0	APEC ESPII	
7	ELITE	30.00
0	BRUT	
8	Other	21.25

32. Place an X next to the energy analysis tools used by AEs on your projects. State the approximate percentage of the time AEs use these tools:

No. Response	Category	Overall Rating
29	Hand calculations	20.07
9	Carrier OPCOST program	23.89
0	ASEAMII program	
4	Other BIN programs	30.75
4	DOE 2.1 (mainframe version)	10.30
5	DOE 2.1 (PC version)	9.00
18	BLAST	11.50
35	Trane TRACE	45.60
5	APEC ESPII	16.00
10	ELITE	8.70
0	BRUT	
3	Other	10.00

33. Place an X in the spaces of the five most important features an energy analysis tool should have for you to use it or permit AEs to use it (assume the application is a new air conditioned building of more than 100,000 sq ft floor area):

51	Calculations are accurate compared to some benchmark
44	Program is easy to learn
37	Program runs on a microcomputer
32	HVAC systems and equipment models are extensive
28	Computation time for an annual run is relatively fast
23	Input required is limited
19	Building model can be very detailed
13	Support for the program is good
13	Program documentation is good
12	Training for the program is good
12	Good capability for passive solar
10	Program uses menus for input
7	Program is public domain
6	I have or AE has used it before
5	There is good capability to perform daylighting calculations
5	Text editor is easy to use
5	Lighting systems models are extensive
4	Program uses "screens" for input
2	Other
2	Good capability for active solar
1	Other

34. State the percentage of energy analyses conducted by the following disciplines in your office:

No. Responses	Discipline	Percent
55	Mechanical engineers	87.54
14	Electrical engineers	26.07
1	Architects	

No. Responses	Discipline	Percent
3	Project managers	11.67
3	Engineering technicians	3.33
1	Other	100.00

35. In your opinion what percentage of energy analyses SHOULD BE performed by the following disciplines in your office?

No. Responses	Discipline	Percent
57	Mechanical engineers	65.28
38	Electrical engineers	33.98
27	Architects	30.08
7	Project managers	22.86
10	Engineering technicians	39.50
2	Other	85.00

36. Please list any suggestions you have for improving energy analysis tools and/or criteria:

37. Have you disapproved the proposed use of any energy analysis program by an AE?

14 Yes responses

SECTION F. BLAST COMPUTER PROGRAM USAGE and REVIEW

38. How often do you use or review BLAST?

23	Less than once a quarter
5	Once a quarter
5	Once a month
1	Once a week
1	More than once a week
14	Other
-	NEVER

39. Place an X in the spaces next to the computer(s) you run BLAST on. State the percentage of runs on that computer for each selection:

No. Responses	Hardware	Percent
8	CDC Cybernet	40.63
20	District Harris	49.25
0	DEC VAX	

40. Place a number in the spaces of the five highest priorities of new features you would like to see in BLAST:

22	More HVAC systems and plants models
16	Integrated loads, systems and plants modules
14	Easy interface with graphics programs for reports
11	Provide better documentation

11	Other
11	Interface with CADD systems
9	Run on a 32 bit microcomputer
7	Microcomputer preprocessor
6	More lighting models
4	Run on a 32 bit engineering workstation
2	Microcomputer postprocessor

41. Would you be interested in helping to demonstrate completed enhancements to BLAST if funds were provided for the demonstration?

15 Yes responses

42. What are your two biggest concerns about using BLAST?

- COMPLEXITY
- TIME

43. Place an X in the spaces next to the means you use to input BLAST. Place a percentage of total runs of each input means in the space provided.

No. Responses	Input Scheme	Percent
8	Regular BLAST input scheme	48.75
13	BTEXT text preprocessor	68.85
2	SKETCH/BIP preprocessor	10.00
3	ARCH/ENERGY preprocessor	65.00

SECTION G. ECONOMIC ANALYSIS STUDIES and REVIEW

44. What percentage of in-house projects involve economic analyses (i.e., life cycle cost studies) to help make design selections?

48 Yes responses 49.02%

45. What percentage of AE projects require similar economic studies?

45 Yes responses 53.2%

46. Have you used the Corps Life Cycle Cost In Design (LCCID) economic analysis computer program?

21 Yes responses

47. What percentage of in-house economic analyses are performed using LCCID?

29 responses 60.21%

48. What percentage of AE performed economic analyses are conducted using LCCID?

11 responses 30.41%

49. Place an X in the spaces for the version of LCCID used by you. State the percentage of that use in the space provided:

No. Responses	Implementation	Percent
1	CDC Cybernet	0.00
6	Harris	30.00
12	Micro	60.59
9	Trane's "Government Economics"	47.27

50. Place an X in the spaces for the version of LCCID used by AEs. State the percentage of that use in the space provided:

No. Responses	Implementation	Percent
2	CDC Cybernet	15.00
0	Harris	
6	Micro	24.17
14	Trane's "Government Economics"	51.79

APPENDIX D:

ARCHITECTURAL CONFERENCE
HARDWARE/SOFTWARE SURVEY

Please take a few minutes to complete the following survey regarding your present and anticipated use of computer hardware and software. The survey is organized into several sections with general and specialized applications questions. Most questions will ask you to respond by placing an Xs in the spaces provided. Where these spaces are followed by _____ (blank lines), please also fill in additional information on the response.

The Corps lacks good information on computer usage. We would like as close to a 100% response on the survey as possible. THIS INFORMATION IS IMPORTANT FOR THE CORPS (and will only be used by the Corps). Your answers will help guide USACE policy on hardware and software for our disciplines.

SECTION A. IDENTIFICATION

1. NAME (optional) _____

2. OFFICE SYMBOL _____

3. TEL. NO. (optional) Comm ( )_____

4. POSITION TITLE _____

5. Percent of work: MILITARY _____% CIVIL _____%

SECTION B. GENERAL

6. Place an X in the spaces for all computer types for which you HAVE ACCESS at work:

__ CDC Cybernet
__ Other Mainframe_____
__ District Harris
__ Other Minicomputer_____
__ Division Honeywell
__ CADD Workstation (Mfr)_____
__ Other(s)_____
__ IBM PC or Compatible
__ Apollo
__ Sun
__ Other 32 bit Workstation
_____
__ APPLE (Model)_____
__ NONE

7. Place an X in the spaces of all computers you USE at work at least occasionally:

__ CDC Cybernet
__ Other Mainframe_____
__ District Harris
__ Other Minicomputer_____
__ Division Honeywell
__ CADD Workstation (Mfr)_____
__ Other(s)_____
__ IBM PC or Compatible
__ Apollo
__ Sun
__ Other 32 bit Workstation
_____
__ APPLE (Model)_____
__ NONE

8. Place an X in the spaces of all computers you WILL HAVE ACCESS TO by the END OF FY88:

__ CDC Cybernet
__ Other Mainframe_____
__ District Harris
__ Other Minicomputer_____
__ Division Honeywell
__ CADD Workstation (Mfr)_____
__ Other(s)_____

__ IBM PC or Compatible
__ Apollo
__ Sun
__ Other 32 bit Workstation
_____
__ APPLE (Model)_____
__ NONE

9. Do you have a computer or terminal on your desk? YES NO
If yes, place an X in the spaces applicable for the computer or terminal on your desk:

__ Terminal (Mfr)_____

__ Computer (Name: PC, PC/XT, Apple IIE, etc.)_____
__ Hard Disk __ 10MB __ 20MB __ 40MB _____ MB

__ Modem _____ Baud

__ Printer __ On Desk __ Remote
__ Daisywheel
__ Dot Matrix
__ Laserprinter

10. Place an X next to the four most important problems IN YOUR OFFICE regarding the use of computer technology:

__ Lack of Hardware
__ Lack of Software
__ Lack of Training
__ No time to learn
__ No good applications for computers
__ Personnel resistance to computers
__ Poor support for computers in office
__ Noise level of computers and printers
__ Expense of computers and software
__ Management does not support computer use
__ Lack of phone lines for modems
__ Present hardware inadequate
__ Architects not given ready access to hardware needed
__ Other(s) List _____
_____

11. Name the function(s) in your office you would most like to automate:
_____
_____

12. Do you own a computer for home use? __ NO __ YES (Type)_____

SECTION C. COMPUTER USAGE

13. Indicate the three (3) types of training you consider most effective FOR YOU on computer hardware or software.

__ Contracted Training
__ Formal Training By Office Staff
__ Computer Tutorials
__ Manuals
__ Telephone Support from Mfr.
__ On the job training
__ Co-workers
__ Other _____
_____

14. Place an X in the spaces for YOUR use(s) of computer hardware and software at work (give name of program(s) where applicable)

__ Wordprocessing _____
__ Spreadsheets Program(s) _____
__ Data Base Managers Program(s)_____
__ Communication Program(s) _____
__ Energy Analysis _____
__ CADD for Drawing _____
__ Scheduling and time management_____
__ Management Information Systems (required by office)
__ Other(s) _____
_____

SECTION D. ARCHITECTURAL SOFTWARE

15. Place an X in the spaces next to the applications for which YOU have used software in at least a portion of the task (also state the program name when asked):

__ Lighting Design and Analysis (Program(s)) _____
__ Estimating and Quantity Takeoffs _____
__ Space Planning/Function layout _____
__ Energy Analysis _____
__ Solids Modeling (Program(s)) _____
__ Structural Analysis _____
__ Other Applications Program(s) _____

16. What task or function do you feel has been MOST successful on a computer?_____

Why?_____

17. What task or function do you feel has been the LEAST successful on a computer?_____

Why?_____

18. Place an X in the spaces next to the five attributes of architectural software that carry the most weight regarding your selection of programs:

__ Price
__ Ease of use
__ Quality of manuals and other documentation
__ Software support from developer
__ Conformance of calculations to results of manual calcs
__ Access to computer code for examination
__ Reputation of developer
__ Graphics input
__ Graphics output
__ Speed of use
__ Advertised features and compliances
__ Previous experience with the program
__ Other _____
_____

19. Have you disapproved a program that an AE wanted to use?

__ NO __ YES Why? _____

20. Place an X in the spaces next to the five most pressing problems you feel the Corps faces in computer use?

__ Users are not consulted before software is developed
__ Too much oversight on software by HQUSACE
__ Not enough oversight on software by HQUSACE
__ Too many programs to choose from
__ Little ability to force AEs to use certain programs
__ Corps labs and Huntsville developing too much useless software
__ CADD systems need improvement in architectural applications
__ Poor interdisciplinary design teamwork
__ Design schedules are too tight to permit learning and using programs
__ Need more money for hardware and software
__ Other_____
_____
_____

21. If it were up to you what would the essential ingredients of the Corps hardware and software usage be?

A._____

B._____

C._____

D._____

SECTION E. ENERGY ANALYSIS

22. What are your principal duties regarding energy analysis?

__ Perform analyses
__ Review analyses
__ Perform and review
__ None

23. Place an X in the spaces of the five most important features an energy analysis tool should have for you to use it or permit AEs to use it (assume the application is a new air conditioned building of more than 100,000 sq ft floor area):

__ Calculations are accurate compared to some benchmark
__ Input required is limited
__ Building model can be very detailed
__ HVAC systems and equipment models are extensive
__ Lighting systems models are extensive
__ There is good capability to perform daylighting calculations
__ Good capability for passive solar
__ Good capability for active solar
__ Program is easy to learn
__ Program runs on a microcomputer
__ Computation time for an annual run is relatively fast
__ I have or AE has used it before
__ Training for the program is good
__ Support for the program is good
__ Program is public domain
__ Program documentation is good
__ Program uses "screens" for input
__ Program uses menus for input
__ Text editor is easy to use
__ Other _____
_____

24. State the percentage of energy analyses conducted by the following disciplines in your office:

__ Mechanical engineers _____%
__ Electrical engineers _____%
__ Architects _____%
__ Project managers _____%
__ Engineering technicians _____%
__ Other _____ _____%

25. In your opinion what percentage of energy analyses SHOULD BE performed by the following disciplines in your office?

__ Mechanical engineers _____%
__ Electrical engineers _____%
__ Architects _____%

__ Project managers _____%
__ Engineering technicians _____%
__ Other _____ _____%

26. Please list any suggestions you have for improving energy analysis tools and/or criteria:

_____

_____

_____

If you do not personally perform any energy analysis, procede to the next section.

27. How often do you personally perform energy analysis calculations?

__ Less than once a quarter
__ Once a quarter
__ Once a month
__ Once a week
__ Other _____

28. Of the energy analyses you perform what percentage are conducted using a computer program?

__ 100%
__ 90%
__ 75%
__ 50%
__ Less than 50%
__ Other _____

29. Place an X in the spaces next to all purposes for which you perform a computer or hand calculation energy analysis.

__ To comply with Energy Budget requirements
__ To compare HVAC alternatives' energy consumption and life cycle costs
__ To compare alternate architectural features such as windows and insulation
__ To compare alternate lighting and/or electrical power systems
__ To size HVAC systems and equipment
__ To select orientation and other siting considerations
__ Other _____

30. Place an X in the spaces next to the energy analysis tools YOU use at work.

__ Hand calculations
__ BLAST
__ Trane TRACE
__ ELITE
__ Carrier OPCOST program
__ DOE 2.1 (Mainframe version)
__ DOE 2.1 (PC version)
__ APEC ESPII
__ BRUT
__ ASEAMII program
__ Other BIN programs _____

SECTION F. ECONOMIC ANALYSES

31. What percentage of in-house design projects in your Section or Branch involve economic analyses (i.e., life cycle cost studies) to help make design selections?

_____%

32. Have you used the Corps Life Cycle Cost In Design (LCCID) economic analysis computer program?

__ NO __ YES

If YES, place an X in the spaces for the version of LCCID you use

__ CDC Cybernet
__ Harris
__ Micro
__ Trane's "Government Economics"

33. What percentage of in-house economic analyses are performed using LCCID?

_____%

THANK YOU VERY MUCH FOR COMPLETING THIS SURVEY

APPENDIX E:

ARCHITECTURAL RESULTS COMPILATION

Hardware/Software Survey Results
Corps Wide Architectural Conference
December 1-3, 1987
Savannah, Georgia

SURVEY ANALYSIS

Section A. Identification

1. Cross-section of Position Titles:

49	Architect
6	Chief, Architectural Section, etc.
2	Project Manager
2	No response
2	Int. Designer
1	Architectural Technician
1	Chief, Military Branch
1	Chief, Mech./Elec/Arch Team

TOTAL: 64

Section B. General

2. Computer use at work:

A. Do you use computers at work:

10	No
54	Yes

B. Of those that said yes:

a) Computer types used at work at least occasionally

47	IBM PC or compatible
-	Compac 386
23	CADD Workstation
-	Intergraph, Autocad, Zenith, IDS
16	District/Division Harris
3	Apple
-	Macintosh, IIC
3	CDC Cybernet
2	Division Honeywell
2	Wang
1	Compaq

1 Apollo
1 Amdahl
1 Zenith Minicomputer
1 Bentley
1 Summagraphics

b) Computer or terminal on desk:

17 Yes
37 No

c) Of those that said Yes, computer or terminal types were:

4 Zenith
4 PC
3 IBM AT
1 Macintosh Plus
1 AMT-XT Plus
1 Xerox
1 Tandy
1 Commodore 64
1 9220 terminal

3. Most important problems regarding use of computer technology in office:

37 Lack of Training
32 No time to learn
28 Lack of Hardware
20 Lack of Software
13 Present hardware inadequate
12 Architects not given ready access to hardware needed
11 Personnel resistance to computers
11 Management does not support computer use
10 Poor support for computers in office
9 Expense of computers and software
7 No good applications for computers
3 Lack of phone lines for modems
2 Noise level of computers and printers

Other(s):

- Plotting technology is poor...maintaining pens, etc. is difficult.
- Lack of plotters.
- Inconsistency in election of software standards within the office...everyone uses what they want to use...makes transfer of information difficult.
- Procurement process is too long...takes too long to get hardware or software once the request leaves the office...especially true with software updates.
- Too few machines.
- Engineering management tries to force architects to use software for which they have not developed an application at the present time.
- No CADD system available.
- In process of changing to a different system.
- Management has selected a poor system...it is slow and inflexible.
- Lack of standardization support at HQUSACE.
- Not enough in-house design to support computers (time and resources available).

- Personnel that were trained are uninspired and/or incompetent.
- Lack of uninterruptable power source for PC's.
- We are encouraged to use computer technology but are given virtually no instruction or time to enable us to become familiar with it.

4. The function(s) in your office you would most like to automate:

- drafting
- design/layout (concept development, floor area calcs.)
- working drawings and details
- standard or repetitive building plans
- all contract documents
- cost estimating/quantity takeoffs
- reference materials
- criteria (ETLs, ARs, TMs, other regulation codes and stds)
- specifications and spec. editing
- review comment generation
- management (project schedules and funding, contract, team)
- general correspondence and job files
- labor accounting
- ARMS
- word processing for reports
- interior design functions

Section C. Computer Usage

5. Types of training considered most effective by the user:

44 On the job training
35 Co-workers
30 Contracted Training
28 Computer Tutorials
17 Formal Training By Office Staff
16 Manuals
5 Telephone Support from Mfr.

Other(s):
- Third party books.
- Self-paced and motivated very effective.
  Extended deadline on project to allow extra time to learn on the job.

6. Types of general software currently in use in office:

40 Wordprocessing
- Multimate, Microsoft Word, Wordstar, Wordperfect, Uniplex/horizon, Wang, Smart, Wordmarc, Sidekick, Volkswriter, Xerox Viewport, Turbo Lighting, Enable

39 CADD for Drawing
- Autocad, Summagraphics, Bentley Microstation, Prodesign, Intergraph ARCH package, IGDS and ADPD, CadPlus by Cadpack, CERLCAD, Pacemaker

30 Spreadsheets Program(s)
- Smart, Symphony, Enable, Lotus 123, Dbase III, Multiplan, Supercalc4

17 Data Base Managers Program(s)
- Dbase III, Enable

11 Scheduling and time management
- Sidekick, Timeline, Metro, Harvard Project Manager, Dbase III, Lotus

7 Communication Program(s)
- Smartcom, Crosstalk, Paxmail, Procomm

3 Management Information Systems (required by office)

Other(s):
- Email/ontyme
- Specifications
- Turbo Pascal
- ARMS
- PC Outline

Section D. Architectural Software

7. Types of architectural software currently in use in office:

28 No response/none used

19 Space Planning/function layout
- ACAD, Intergraph ADPD and SPFM, Prodesign, Autocad, CERLCAD

5 Estimating and Quantity Takeoffs
- Intergraph ARCH package, CACES

3 Energy Analysis
- Solarsoft...SOLPAS, SOLFEAS, DAYLIT

2 Solids Modeling (Program(s))
- Intergraph

2 Structural Analysis

1 Lighting Design and Analysis (Program(s))

Other(s):
- 1391 Processor
- BLAST
- IGDS
- Drafting with Autocad
- Comment writing with Enable
- Specification writing
- Window details with Pella program

8. What task or function do you feel has been MOST successful on a computer:

- drafting, CADD (Autocad, floor plans, production drawings, elevations, building layout) drawing elements tend to be repetitive; standardization graphics quality and efficiency; increase productivity while maintaining ability to explore; producing construction drawings has been a means of training and instruction; although its just beginning, CADD is showing the potential for linking all design disciplines from planning to construction; efficiency and interdisciplinary controls; floor plans need only be drawn once for the architectural sheets - and then used as a base by the other disciplines. Plus as jobs are developed, the details can be put into a library and used on future jobs (again saving time) with little or no modifying; that is the least that should be done on a computer; the ease at which changes can be made; changes to plan are easily made - accurate plans are available for other disciplines

- space planning/function layout (drafting) ease of developing multiple solutions and ease of change
- concept development speed
- making changes to computerized construction documents changes were quicker on all sheets
- database connected reports to architectural plans
- CADDKEY by Summagraphics easy to learn; useful for repetition of details
- word processing most exploited; most training; accessible to most people for some use with minimal training and new skills required; we do our own reports - has cut down delays and problems with word processing center; ease; frees me from dependence on a secretary who can't type; greatest quantity with least amount of training; at desk composing without secretary; universal applications
- spreadsheets, these are what we have been able to use for any length of time; retrieval and storage of data; universal applications
- Lotus spreadsheets with word processing interfaces; excellent management tool for upward reporting
- simple database storage and manipulation; relatively easy to set up and use
- narrative review comments quicker
- A/E fee estimates it is the only task I do on computer
- 1391 processor

9. What task or function do you feel has been the LEAST successful on a computer:

- design (architectural design) the system was too small - no reference; no access to computer hardware for individual use; too many decisions require simultaneous input; easier to draw on table; poor choices of software; it will take some time for thinking processes to shift to computer software design (from traditional methods). Software dictates more "upfront" thinking when laying out plan; need for familiarity with system before you can design with it; programs are set up for drafting and are too restrictive and time consuming for design techniques
- drafting (Autocad, CADD, working drawings) unique drawings not efficient on computer; too slow - in the future, development of more developed software and hardware; training time is longer than expected. Plotters take too long. Power outages; some staff is uninspired/incompetent; none available
- comment writing with Enable software is too cumbersome - not simple enough for quick learning
- estimating lack of applications knowledge in estimating
- specifications redundancy - if we edit on our own computer (big no-no) we're taking work away from wordprocessing people;
- 3B2 with terminals - the system we have just does not work - will have very few users
- drawings/specifications coordination learning curve/data entry
- word processing resistance of people to learn to type
- trying to train people with manufacturer's stock training programs
- CACES is applied to small and large projects alike
- scheduling - don't think we have the right system yet
- data base - difficult to work with; too involved for my needs

10. Attributes of architectural software that carry the most weight regarding your selection of programs:

39 Ease of use
32 Graphics output
29 Speed of use
25 Graphics input
24 Quality of manuals and other doc.

19 Software support from developer
13 Price
9 Previous experience with the program
5 Reputation of developer
2 Access to computer code for examination
0 Conformance of calculations to results of manual calcs
0 Advertised features and compliances

Other(s):

- Ease of customizing
- Convenience of use
- Hardware use (easy or not)
- Degree to which software supports traditional design tasks in a comprehensible order
- Quality of software
- Training available

11. Most pressing problems Corps faces in computer use:

36 Design schedules are too tight to permit learning and using programs
25 Need more money for hardware and software
24 Poor interdisciplinary design teamwork
14 CADD systems need improvement in architectural applications
12 Users are not consulted before software is developed
10 Corps labs and Huntsville developing too much useless software
7 Too many programs to choose from
7 Little ability to force AEs to use certain programs
6 Not enough oversight on software by HQUSACE
3 Too much oversight on software by HQUSACE

Other(s):

- All Corps offices should use the same system...no standardization between divisions and districts
- Misdirection in purchase and procurement of hardware and software...management buys mainframes, users want PCs.
- Upper management
- Management does not support Corps wide CADD buy
- Management is not prepared to plan the design process/office organization and arrangements to take advantage of computer products.
- Need more hardware and software
- Getting hardware to work all the time
- Not enough information available as to what software is available...and its applicability to work being done
- Training is inadequate
- No CADD system is available
- Development of AE computer support and funding at the office...cannot rely on local ADP department
- Hardware and software not state-of-the-art yet
- Not enough in-house work to support CADD
- Design sections do not share "lessons learned" information.

12. If it were up to you what would the essential ingredients of the Corps hardware and software usage be?

- a. Corps should buy same system for all offices

b. Document storage should be standardized and efficient
c. As-built drawings should be required

- a. Intergraph CADD for concept development and working drawings
b. Complete utilization by other expertise
c. Solid modeling program Intergraph 32 to aid in concept development

- a. Network AE Districts, Divisions, and Headquarters for drawings, specifications, estimates, communication and other information

- a. Compatibility
b. Ease of use
c. Application throughout design/construction process
d. Ease of access

- a. More workstations - one for everyone who uses one regularly
b. Consistency

- a. (CADD) Hardware - machines, printers, storage
b. (CADD) Corps wide policies
c. (MANG) Hardware/software. No hardware - we went though 5 word processing programs this year
d. (MANG) Education to per computer generations

- a. User friendly software

- a. Experienced districts helping the inexperienced get going
b. Large library of building details and data to interchange Corps-wide

- a. Insure training is available
b. Ease of use
c. Non-proprietary, i.e. expandable

- a. More purely "design" software, not drafting

- a. Color graphics workstation, minimum one per three employees
b. Architectural software that supports typical contract document production
c. Software that supports bubble diagrams/adjacency matrices

- a. Preconcept - both to develop project and as a presentation vehicle - including 3D modeling
b. Project drawings with as-built changes/corrections added when appropriate

- a. Sheets or cells of standard details should be developed on the CADD for Corps wide use. The drawings should include door details, CMU details, caulking details, roof details, handrails, windows, metal roofing. (Would be very interested in developing these drawings. Perhaps Huntsville Division would be the proper location for distribution of this data since they already manage standard designs.)

- a. Training
b. Dedicated personnel to CADD
c. Realization of the time required to "get up to speed"

d. Realize difference in personnel classification between "engineering/architectural CADD production" and "word processing"

- a. PC's with a tie to the Harris
  b. Something more user friendly than autocad 2.52 for drafting
  c. Better plotters than HP. Its good but pens are a problem and plots take so long

- a. Ease of use
  b. Adequate training of enough people
  c. Enough terminals to handle work load

- a. Training
  b. Sharing of details so that we don't reinvent the wheel

- a. User friendly to accomplish task
  b. Graphics ability

- a. Sufficient hardware/software
  b. Ease of use - user friendly
  c. Flexible - easy to adapt or modify to individual situation

- a. User friendly
  b. Readily available
  c. Easily procured
  d. Easily modified by the user without ADP programmer support

- a. Development of good training programs
  b. Allow time for development of skills without pressure on performance and schedules
  c. Development of standard methods of operation
  d. Development of standard details with proper filing system

- a. Provide information on software to possible users

- a. User friendly

- a. We are gaining - but visualize the day when everything is geared to the design drawings which is the first and last outbreak of our thinking) ie, specifications and estimates. Also, since engineering for facilities is an applied science, you would not need a structural engineer telling you it can't be done. The computer will tell you your options and you get to make a decision - something architects are trained to do.

- a. Provides additional hardware for technical groups primarily funding for PC's and printers

Section E. Energy Analysis

13. Principal duties regarding energy analysis:

41 None
14 No response

4 Review analyses
3 Perform analyses
1 Perform and review

14. Place an X in the spaces of the five most important features an energy analysis tool should have for you to use it or permit AEs to use it (assume the application is a new air conditioned building of more than 100,000 sq. ft. floor area):

14 Program runs on a microcomputer
12 Good capability for passive solar
12 Program is easy to learn
9 Calculations are accurate compared to some benchmark
8 There is good capability to perform daylighting calcs
7 Computation time for an annual run is relatively fast
6 Input required is limited
6 Building model can be very detailed
5 HVAC systems and equipment models are extensive
5 Training for the program is good
5 Program documentation is good
4 Support for the program is good
4 Program is public domain
3 Program uses menus for input
3 Text editor is easy to use
3 Lighting systems models are extensive
2 I have or AE has used it before
2 Program uses "screens" for input
1 Good capability for active solar

Other(s):

- BLAST is far too academic and detailed for the HVAC equipment available. For example, after complicated BLAST procedures, an eight ton unit is selected. This is when a Trane Program would do the same job faster and cheaper.

15. State the percentage of energy analyses conducted by the following disciplines in your office:

	0-5	10-15	20-25	30-35	40-45	50-55	60-65	70-75	80-85	90-95	100%
Mech. Engineers				1	1	3	2	2	1	7	20
Elec. Engineers	1		4	1		3					2
Architects	1	8			2	1					
Project Mgrs		1									
Engineering Tech			1			1					
Energy Anal. Section											1

16. State what percentage of energy analyses SHOULD BE conducted by the following disciplines in your office:

	0-5	10-15	20-25	30-35	40-45	50-55	60-65	70-75	80-85	90-95	100%
Mech. Engineers		1		2	3	5	2	5	2	4	9
Elec. Engineers	2	4	5	2	1	1	2			1	1
Architects		6	10	2	2	2					2
Project Mgrs	1	1									
Engineering Tech.			3			1					
Energy Anal. Section											1

17. Please list any suggestions you have for improving energy analysis tools and/or criteria:

- Use by architects should be quick and simple for design considerations only. Accurate analyses should be done by mechanical engineers.
- Architects should perform
- Classes
- Simplify
- Develop interactive real-time DOS-based software that takes IGDS file (interface to Bentley) and performs graphic input/output analysis of heating, cooling, and ventilation loads, etc.
- There is a need for better lighting/daylighting programs showing the effect of these elements on the HVAC system.

18. Place an X in the spaces next to all purposes for which you perform a computer or hand calculation energy analysis.

7 To compare alternate architectural features such as windows and insulation
6 To select orientation and other siting considerations
3 To compare alternate lighting and/or electrical power systems
3 To size HVAC systems and equipment
2 To comply with Energy Budget requirements
2 To compare HVAC alternatives' energy consumption and life cycle costs

Other(s):
- To meet minimum insulation requirements

19. Place an X in the spaces next to the energy analysis tools you use at work.

7 Hand calculations
1 BLAST
1 Solarsoft

Section F. Economic Analyses

20. Does in-house design process include economic analysis?

25 No response
21 Yes
18 No

21. Have you used the Corps Life Cycle Cost In Design (LCCID) economic analysis computer program?

39 No
16 No response
4 Yes (Harris, Micro)

22. Are in-house economic analyses performed using LCCID?

35 No response
9 Question mark
8 No
5 Yes
2 Don't know

APPENDIX F:

ARCHITECTURAL RESPONDENT IDENTIFICATION

Corps Wide Architectural Conference Attendees
December 1-3, 1987
Savannah, Georgia

Office Symbol		Surveys Returned
AFRCE		
ATEN	HQ. TRADOC	1
DEH	Ft. Benning	
	Ft. Stewart	
FCEN(FORSCOM)	Ft. McPherson,	
HQDA		
CEEC	HQUSACE	
CEEC-OVEST	HQUSACE-OVEST	
CECER	Const. Eng. Res. Lab.	
CECRL	Cold Regions Res. & Eng. Lab	

Office Symbol		Division/ District	Surveys Returned
CEEUD	Europe Division	EUD	
CEHND	Huntsville Division	HND	3
CELMD	Lower Miss. Valley Div.	LMK	1
		LMN	1
CEMRD	Missouri River Division	MRD	
		MRK	2
		MRO	2
CENED	New England Division	NED	2
CENAD	North Atlantic Division	NAB	3
		NAO	2
CENCD	North Central Division	NCS	1

Office Symbol		Division/ District	Surveys Returned
CENPD	North Pacific Division	NPD	3
		NPP	1
		NPS	2
		NPW	1
CEORD	Ohio River Division	ORD	1
		ORL	5
CEPOD	Pacific Ocean Division	POD	1
		POF	1
		POJ	1
CESAD	South Atlantic Division		
		SAC	1
		SAJ	1
		SAM	1
		SAI	1
		SAS	4
		SAW	2
CESPD	South Pacific Division	SPD	1
		SPL	1
		SPK	9
CESWD	Southwestern Division		
		SWF	1
		SWL	1
		SWT	1
		TOTAL:	58

NOTE: 6 attendees did not give their name or office symbol on the completed survey.

USACERL DISTRIBUTION

Chief of Engineers

ATTN: CEIM-SL (2)
ATTN: CEMP-C
ATTN: CERD-L

ATTN: CEMP-EE
ATTN: CEMP-EA
ATTN: CEMP-ES
ATTN: CESPK-ED-DA
ATTN: CESWT-EC-DB
ATTN: CEWES-IM-D (2)

ATTN: DTIC